can exist. This may to some extent account for the reluctance which English capitalists feel in embarking in the manufacture of artificial colouring matters. That England possesses both in the scientific and in the practical direction ability equal to the occasion none can doubt. But be that as it may, the whole honour of the discovery of artificial indigo belongs to Germany and to the distinguished chemist Prof. Adolf Baeyer, whilst towards the solution of the difficult problem of its economic manufacture, the first successful steps have been taken by Dr. Caro and the Baden Aniline and Soda Works at Mannheim.

H. E. R.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Linacre Chair of Physiology and Anatomy, lately held by Dr. Rolleston, and practically a chair of comparative zoology, will now be split into two, being succeeded by chairs of anatomy proper and physiology proper, with a more direct relation to the teaching of those subjects as part of a preliminary medical education, as was intended by Dr Linacre.

DR. OLIVER J. LODGE has been appointed to the Lyon Jones Professorship of Experimental Physics and Mathematics in University College, Liverpool, by the Councils of that College and of the Liverpool Royal Infirmary School of Medicine. Prof. Lodge has been some time Assistant-Professor of Physics at University College, London, and is the author of a work on elementary mechanics and various papers of original research.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 16.—"On the Stresses caused in the Interior of the Earth by the Weight of Continents and Mountains," by G. H. Darwin, F.R.S.

The existence of dry land proves that the earth's surface is not a figure of equilibrium appropriate for the diurnal rotation. Hence the interior of the earth must be in a state of stress, and as the land does not sink in, nor the sea-bed rise up, the materials of which the earth is made must be strong enough to bear this stress.

We are thus led to inquire how the stresses are distributed in the earth's mass, and what are magnitudes of the stresses.

In this paper a problem of the kind indicated is solved, by the use of certain results obtained by Sir William Thomson, for the case of a homogeneous incompressible elastic sphere, and the results are applied to the case of the earth.

If the earth be formed of a crust with a semi-fluid interior the stresses in that crust must be greater than if the whole mass be solid, far greater if the crust be thin.

The strength of an elastic solid is estimated by the difference between the greatest and least principal stresses, when it is on the point of breaking, or, according to the phraseology adopted, by the breaking stress-difference. The most familiar examples of breaking stress-difference are when a wire or rod is stretched or crushed until it breaks; then the breaking load divided by the area of the section of the wire or rod is the measure of the strength of the material. Stress-difference is thus to be measured by tons per square inch.

The problem is only solved for the class of inequalities called zonal harmonics; these consist of a number of waves running round the globes in parallels of latitude. The number of waves is determined by the order of the harmonic. In application to the earth the equator referred to may be any great circle, and is not necessarily the terrestrial equator. The second harmonic has only a single wave, and consists of an elevation at an equator and depression at the pole; this constitutes ellipticity of the spheroid. An harmonic of a high order may be described as a series of mountain chains, with intervening valleys, running round the globe in parallels of latitude, estimated with reference to the chosen equator.

In the case of the second harmonic it appears that the stress-difference rises to a maximum at the centre of the globe, and is constant all over the surface. The central stress-difference is eight times as great as the superficial.

Amongst other examples it is shown that if the homogeneous earth, with ellipticity $\frac{1}{232}$, were to stop rotating, the central stress-difference would be thirty-three tons per square inch, and it would rupture if made of any material excepting the finest steel.

The stresses produced by harmonic inequalities of high orders are next considered. This is in effect the case of a series of parallel mountains and valleys, corrugating a mean level surface with an infinite series of parallel ridges and furrows.

Numerical calculation shows that if we take a series of mountains, whose crests are 4000 meters, or about 13,000 feet above the intermediate valley-bottoms, formed of rock of specific gravity 2·8, then the maximum stress-difference is 2·6 tons per square inch (about the tenacity of cast tin); also if the mountain chains are 314 miles apart, the maximum stress-difference is reached at 50 miles below the mean surface. It appears that there is no stress at the surface, but the solution is only approximate, for it does not give the stress actually within the mountain masses, but gives correct results at some three or four miles below the mean surface.

The cases of the harmonics of the 4th and higher orders are also considered; and it is shown that, if we suppose them to exist on a sphere of the mean density and dimensions of the earth, and that the height of the elevation at the equator is in each case 1500 meters above the mean level of the sphere, then in each case the maximum stress-difference is about four tons per square inch. This maximum is reached in the case of the 4th harmonic at 1150 miles, and for the 12th at 350 miles, from the earth's surface.

It is then shown that the great terrestrial inequalities, such as Africa, the Atlantic Ocean, and America, are represented by an harmonic of the 4th order; and that, having regard to the mean density of the earth being about twice that of superficial rocks, the height of the elevation is to be taken as about 1500 meters.

Four tons per square inch is the crushing stress-difference of average granite. From these results it may be concluded that either the materials of the earth have about the strength of granite at 1000 miles from the surface, or they have a much greater strength nearer to the surface.

This investigation must be regarded as confirmatory of Sir William Thomson's view, that the earth is solid nearly throughout its whole mass. According to this view the lava which issues from volcanoes arises from the melting of solid rock, which exists at high temperature at points where the pressure is diminished, or else from comparatively small vesicles of rock in a molten condition.

Zoological Society, June 21.—Prof. W. H. Flower, F.R.S., president, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of May, 1881, amongst which special attention was called to an African Wild Ass (*Equus tæniopus*) from Upper Nubia, and a White-marked Duck (*Anas specularis*) from Antarctic America, both new to the collection.—Mr. R. Bowdler Sharpe exhibited a specimen of *Podilymbus podiceps*, stated to have been killed at Radipole, near Weymouth, in the winter of 1880-81.—Mr. W. A. Forbes read a paper on the Petrel called *Thallassidroma nereis*, by Gould. This, he showed, was not a true *Procellaria*, but must form the type of a new genus, to be called *Garrodia*, most closely allied to *Oceanites*, *Fregetta*, and *Pelagodroma*, and constituting with them a distinct family of "Tubinares," proposed to be called "Oceanitidæ."—Mr. W. A. Forbes read a paper on the conformation of the thoracic extremity of the trachea in the "Ratite" birds, noting specially a highly-developed syrinx in the genus *Rhea*, in which respect it differed from all the other genera comprised in that group.—A communication was read from Mr. George F. Bennett, C.M.Z.S., containing an account from personal observation of the habits of the *Echidna hystrix* of Australia.—Mr. G. A. Boulenger read a paper on the Lizards of the genera *Lacerta* and *Acanthodactylus*, prepared after a study of specimens in the British Museum.—Mr. F. C. Selous read a paper on the Antelopes that had come under his observation in Central South Africa. He exhibited a series of skins of the Bush-Buck (*Tragelaphus sylvaticus*), and pointed out their variations in different locallities; also specimens of the Poku (*Cobus vardoni*), and the Speke's Antelope (*Tragelaphus Spekii*).—A communication was read from the Rev. O. P. Cambridge, describing some new genera and species of Araneidea.—Mr. Sclater pointed out the generic divisions of the Bucconidæ which he proposed to adopt in his monograph of the group now approaching completion, and characterised a new species of the family under the name *Nonnula cineracea*.—Mr. R. Bowdler Sharpe communicated some notes on new or rare species of Flycatchers lately added to the British Museum, principally from the Gould collection, and which it was proposed to call *Malurus cyanochlamys*, *Siphia obscura*, and *Rhipidura Macgillivrayi*.—A second paper by Mr. Sharpe contained an account of several collections of birds formed by Mr. W. B.

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Pryer in the district of Sandakan, in North-Eastern Borneo. Two new species were described as *Lanius Schalowi* and *Dicæum Pryeri*.—Lieut.-Col. H. H. Godwin-Austen read the second portion of his paper on the land shells collected by Prof. J. Bayley Balfour during his recent expedition to the Island of Socotra. It referred to the family *Helicaceæ*.—Mr. G. E. Dobson communicated some notes on certain points in the muscular anatomy of the Green Monkey *Cercopithecus callithrix*.—Dr. A. Günther exhibited and read a description of a specimen of *Schedophilus medusophagus*, a Mediterranean fish new to the British fauna, lately captured off the coast of Ireland.

Anthropological Institute, June 14.—Major-General A. Pitt-Rivers, F.R.S., president, in the chair.—General Pitt-Rivers read a paper on the discovery of flint implements in the gravel of the Nile Valley, near Thebes. The worked flints were found embedded two or three metres deep in stratified gravel. Much interest has always been attached by anthropologists to this subject on account of its bearing on the antiquity of man. While in Europe we know that the use of stone for implements preceded the employment of metals, and was coeval with many animals that are now extinct, we have hitherto had no certain evidence that this period in northern regions, remote as it undoubtedly was, may not have been contemporaneous with the very earliest phase of Egyptian civilisation, traced backward as it is by the now accepted chronology of Manetho to an antiquity of 7000 years from the present time. Now, however, the evidence of human workmanship has been found in gravel deposits which had become so indurated that the ancient Egyptians were able to cut flat-topped tombs in it, supported by square pillars of gravel, which have retained their form uninjured to the present day, proving an enormously greater age for the flints embedded in the gravel, some of which were chiselled out of the sides of the tombs.—Mr. Alfred Tylor read a paper on the human fossil at Nice discovered by M. Ischa in December, 1880.—Mr. F. E. im Thurn read a paper on some stone implements from British Guiana.—Mr. J. Park Harrison exhibited a collection of Danish and French photographs.—The following papers were taken as read:—Mr. Gerard A. Kinahan, on sepulchral remains at Rathdown, co. Wicklow.—Mr. J. H. Madge, notes on some excavations made in Tumuli, near Copiapo, Chili, in June, 1880.—A number of specimens collected by Mr. Madge were exhibited, among which were two skulls, a quantity of pottery, and a cervical vertebra, in which was embedded a stone arrow-head.

Paris

Academy of Sciences, June 27.—M. Wurtz in the chair.—The following papers were read:—Observations of Comet *b* 1881 (comet of 1807) at the Paris Observatory, by MM. Bigourdan, Wolf, and Thollon; note by M. Mouchez (see p. 223).—On the prolegomena of a new treatise on meteorology, published in Italy by M. Diamilla-Müller, by M. Faye. The first part is entitled "The Laws of Tempests (according to Faye's theory)," and M. Faye expresses satisfaction that his views seem to be gaining ground. In a letter to the author he suggests that in thunder-storms the source of electricity is not merely charged air (and icy particles) whirling downwards from upper regions, but electricity is developed in the act of gyration (reminding us of a Holtz machine working up a weak charge).—M. Janssen presented a photograph of the comet.—On Fuchsian functions, by M. Poincaré.—On the injuries to vegetation produced in treatment of phylloxerised vines, by M. Catta.—Influence of variations of atmospheric pressure on the duration of oscillations of the pendulum, by M. Saint-Loup. He found an advance of 0·077s. to occur in the day for a lowering of mercury pressure 10 mm. The experiment was of a preliminary nature.—Observations on the comet, and principally on the physical aspect of the nucleus and the tail, by M. Flammarion. He inclines to the view that comets' tails are not material—perhaps an excitation, electric or other, of ether. Their transparence favours this view. He also calculates that the tail of the comet of 1843, at the distance of the earth from the sun, must have swept space with a velocity of 64,000,000 of metres per second. Any molecule of matter flying at such a rate would not remain a single instant dependent on solar attraction, and would not go in a closed orbit.—On the surface with sixteen singular points, by M. Darboux.—On the surfaces for which the co-ordinates of any point are expressed by Abelian functions of two parameters, by M. Picard.—On a general means of determining the relations between the constants contained in a particular solution and those contained by the rational co-efficients of the corresponding differential equation, by M. Dillner.—On the vibratory forms of circular liquid surfaces, by M. Decharme. The internodal distances are inversely proportional to the corresponding numbers of vibrations; and this result is independent of the nature of the liquid. There is the greatest similarity between the vibratory forms in question and those of soapy pellicles of the same diameter.—On the employment of liquid prisms in the direct vision-spectroscope, by M. Zenger. On the anterior plane of a liquid prism he fixes a quartz prism of the same refringent angle, but placed in an opposite direction; the posterior face has, as usual, a plane parallel plate. The loss of light by reflection at the anterior and posterior surfaces is thus reduced to a minimum; the spectra are very intense, and the lines are well defined.—Photography of colours, by coloration of layers of coagulated albumen, by MM. Cros and Carpentier. M. Edm. Becquerel pointed out that it was not an immediate photographic reproduction of images with the natural colours of bodies, but a polychrome working by way of photographic impression, in which the tints of images are varied at will with the shades of the colouring matters used, and are not connected in any necessary manner with the colours of the active rays.—Pneumatic apparatus; pneole, spirelle, by M. de Romilly. In the pneole a jet of water sent upwards (say) by a turbine immediately enters an orifice (larger than that it comes from) of a vertical conical pipe, in which some of the water accumulates; and through this water numerous bubbles of air ascend, but cannot return. The water returns to the turbine by a lateral pipe. The spirelle (also for producing an air current) is entirely immersed in the circulating liquid (say in a turbine). It consists in one case simply of a slit of special position and nature in a tube which rises from the liquid, one edge of the slit is higher than the other.—On silicium, by MM. Schutzenberger and Colson.—On a cyanic ether of borneol, by M. Haller.—On the *rôle* of phosphoric acid in volcanic soils, by M. Ricciardi. This is a reply to M. de Gasparin.—On the volcanic soil of Catania, by M. Tedeschi di Ercole.—Unilateral phenomena, inhibitory and dynamogenic, due to an irritation of the cutaneous nerves by chloroform, by M. Brown-Séquard.—New mode of electric excitation of nerves and muscles, by M. d'Arsonval. In the apparatus described he aims at giving the induction current a mathematically definite value, easy to reproduce, rendering the electric excitation purely mechanical (not chemical), and at having an induced current of neutral direction (no positive or negative pole).—On the etiology and pathogeny of variola in the pigeon, and development of infectious microbes in lymph, by M. Jolyet.—Influence of nature of food on the development of the frog, by M. Yung. The substances tried stand in the following decreasingly favourable order:—Beef, fish, coagulated albumen of hens' eggs, albuminoid substance of frog's egg, vegetable substances (algæ). The two latter do not suffice to transform the tadpole into a frog. A purely albuminous substance suffices.—Metamorphosis of the Pedicellata, by M. Barrois.—On the formation of the cyst in muscular trichinosis, by M. Chatin.

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